
South Dakota WILDLIFE REPORT

Elk Population Status Update

2022 Biennial Report

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INTRODUCTION

Native to South Dakota, elk (*Cervus elaphus*) are the largest hunted member of the deer family (Cervidae) residing in the state. Extirpated in the late 1800s, the re-establishment of elk in South Dakota is a wildlife management success story. Today several thousand elk roam free, primarily in the Black Hills forested region along with several smaller herds occupying prairie and/or agriculture landscapes. Public demand for elk hunting opportunities is strong, with hunters submitting 37,205 applications for 1,424 available elk licenses in 2021.

Elk hunting seasons in South Dakota provide an important recreational opportunity for resident sportsmen and women, and also provide a means to manage elk populations. The South Dakota Department of Game, Fish, and Parks (SDGFP) serves to connect people and families to the outdoors through effective management of our State's parks, fisheries, and wildlife resources. South Dakota's elk resources demand prudent and increasingly intensive management to accommodate numerous and varied public demands and growing impacts from people (SDGFP 2021). More specific information on elk management objectives and strategies in South Dakota can be found in the South Dakota Elk Action Plan at https://gfp.sd.gov/UserDocs/docs/elkactionplan_2021_final.pdf.

The following report provides a statewide overview of elk surveys and assessments conducted by the SDGFP and an update on the population status of elk in the Black Hills.

POPULATION SURVEYS AND ASSESSMENTS

Population Assessments

The majority of elk herds in South Dakota occur within the Black Hills. The current Black Hills winter population objective (excluding Custer State Park and Wind Cave National Park) is 6,000-8,000 depending on habitat conditions (SDGFP 2021a). The current population objective for Custer State Park (CSP) is 500-600 wintering elk depending on habitat conditions. These goals were developed after thorough analyses of elk population data, available habitat resources on public land, private land depredation issues, and substantial input from a wide variety of publics with an interest in elk management in South Dakota.

The primary surveys and data assessments used to evaluate elk population abundance and trends in the Black Hills include the following: 1) hunting season evaluations (harvest surveys, harvest age structure, disease testing), 2) herd composition surveys, 3) survival monitoring, 4) aerial sightability surveys, and 5) population modeling.

Survey data are lacking for most prairie units and elk densities are primarily managed to abate substantial agricultural damages on private property while at the same time to provide recreational hunting opportunity.

Hunting Season Evaluations

Elk hunting licenses in South Dakota are limited in all management units and issued through a lottery draw system. For all elk hunting units and seasons (excluding CSP), up to 50% of elk licenses allocated in each management unit are available to those who qualify for landowner/operator preference. Based on current South Dakota Administrative Rules (ARSD), the 2020 and 2021 hunting seasons in the Black Hills began with the archery season open September 1-30 (ARSD 41:06:43). The firearm season for “any elk” licenses ran Oct 1-31 (ARSD 41:06:26:01). Antlerless firearm hunting seasons were October 15-31, Dec 1-16, and Dec 17-31. Contingency licenses are made available for Black Hills units after the harvest seasons have been set if weather and range conditions necessitate a reduction to the grazing pressure on the landscape. No contingency licenses were issued in 2020 and 20 were issued in 2021. Hunting seasons in CSP (ARSD 41:06:27, 41:06:28, 41:06:47, 41:06:48) are similar but may vary depending on Park objectives. Prairie elk hunting seasons (ARSD 41:06:59) vary and are a collaborative effort between SDGFP and private landowners to manage elk populations in agricultural settings.

There are currently eight elk management units in the Black Hills (Units H1, H2, H3, H4, H5, H7, H9, and CSP; Figure 1). Several of these units are further subdivided by area and season date for purposes of antlerless harvest management. In addition, there are currently seven prairie elk management units with hunting seasons (Units 09, 11, 15, 27, 35a, 35b, WRA; Figure 1).

Management objective directions (increase, maintain, or decrease) are set every two years when season recommendations are brought forward to the SDGFP commission (Figure 1). Elk management objectives for each management unit are based on elk population assessments, habitat conditions, and social considerations. Management objectives on the prairie can vary substantially between areas.

Harvest Surveys

All elk hunters, regardless of hunting success or participation, are currently surveyed to assess overall harvest and hunter success. In addition, all successful hunters are required to check-in any harvested elk to a SDGFP representative within 24 hours (ARSD 41:06:04:19). Hunter survey cards are emailed and/or mailed to all elk license holders to obtain information on the number of hunting recreation days, gender and age (adult/calf) of elk harvested, type of land hunted (public vs. private), number of elk shot but not recovered, and mean satisfaction of the hunt. All license holders who list an email in their licensing profile receive an email at the end of the season followed by two reminder emails over a 2-week period. All license holders that do not list an email, and those that do not respond to the email survey, are sent paper surveys followed by two or three subsequent mailings at 12–14-day intervals in order to maximize response rate and precision by limiting non-response bias.

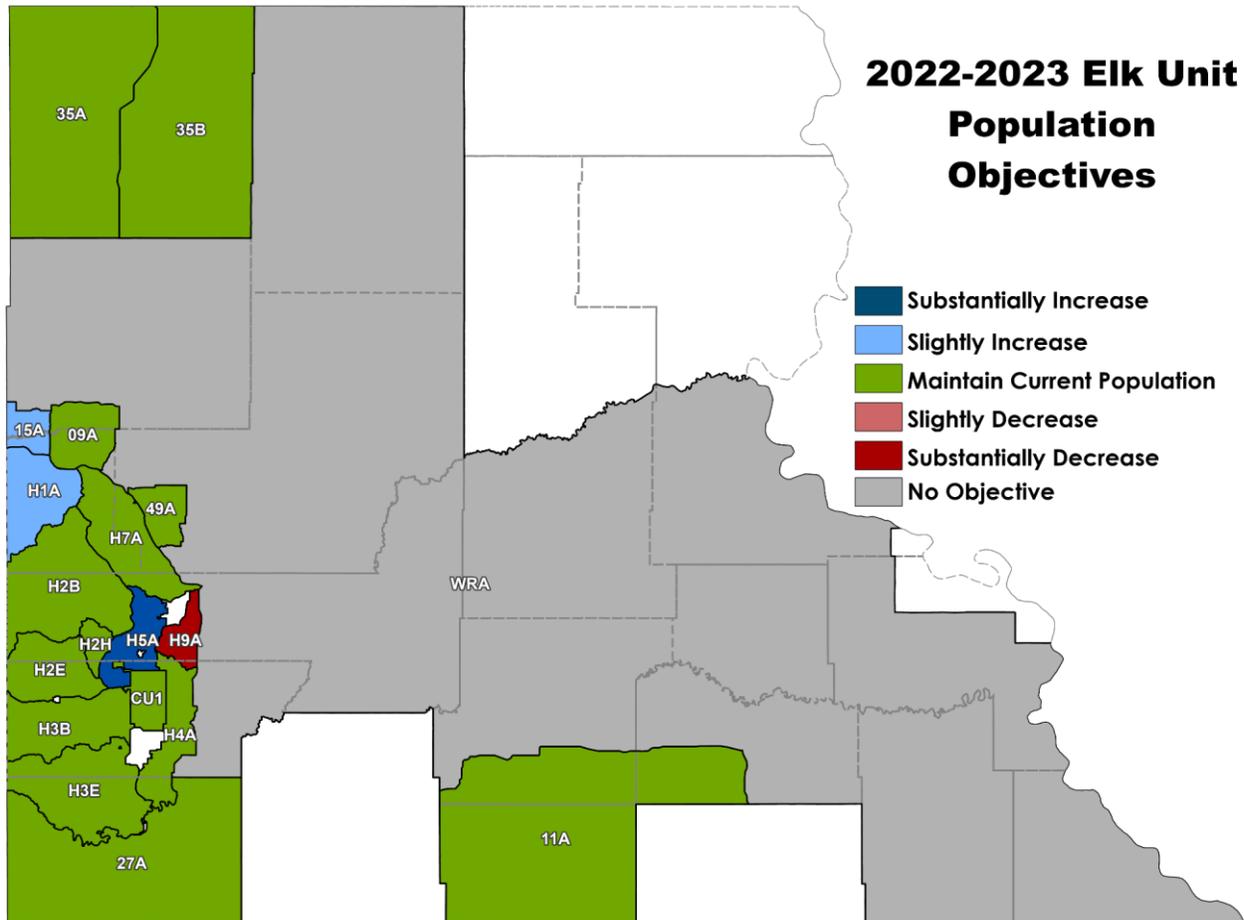


Figure 1. Population objective directions for elk units in South Dakota, 2022-2023.

Returned hunter surveys are entered and summarized, and harvest statistics are generated for each unit. Proportional statistics from the sample are then accepted as representative of the unit population of hunters and applied to the total number of hunters in that unit. Hunters who do not respond to the survey are included in the hunter population when estimating harvest statistics. Confidence intervals are calculated to monitor precision. Harvest information specific to each season, unit, and license type are published annually (Huxoll 2022).

Over the past 10 years, peak elk harvest occurred in 2016 and 2017 at 1,187 and 1,149, respectively (Figure 2). Significant increases in antlerless license types and subsequent cow harvest were obtained during these years to meet population management objectives (Figures 2 and 3). The availability of “any elk” license types has remained relatively stable since 2010 (Figure 3). From 2004 to 2021, the average number of “any elk” and antlerless elk licenses sold each year has been 650 and 888, respectively.

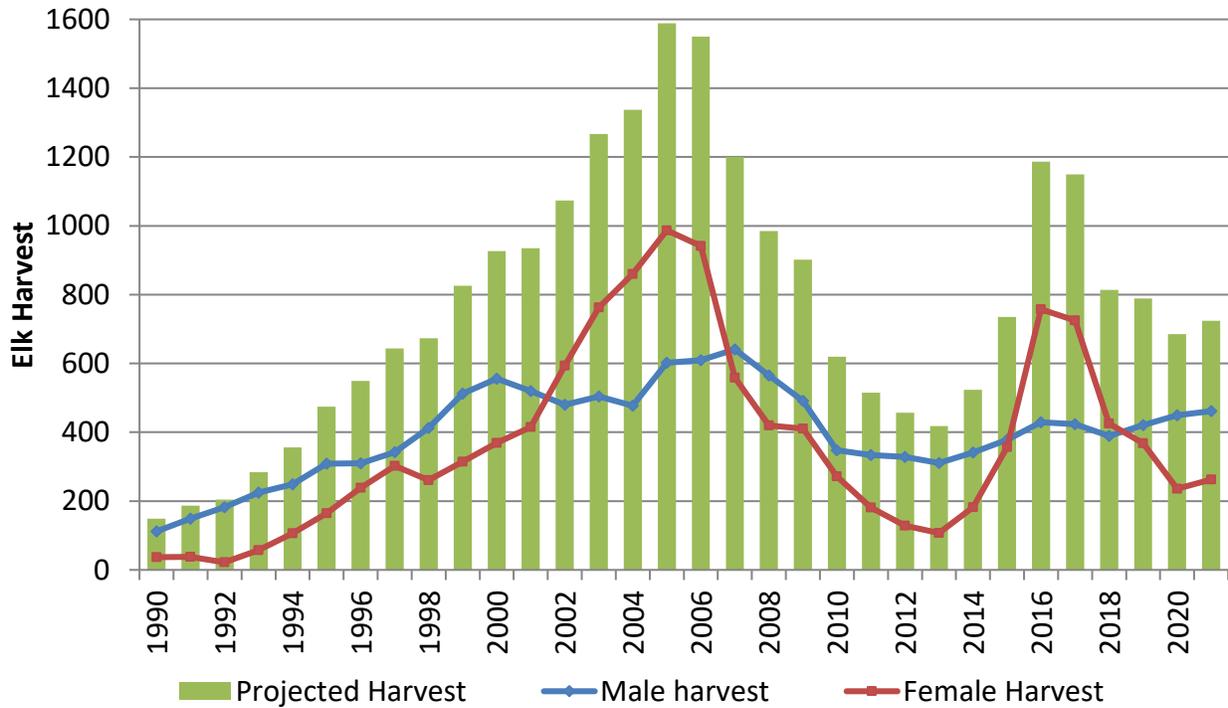


Figure 2. Harvest of elk from all hunting seasons in the Black Hills, 1990-2021.

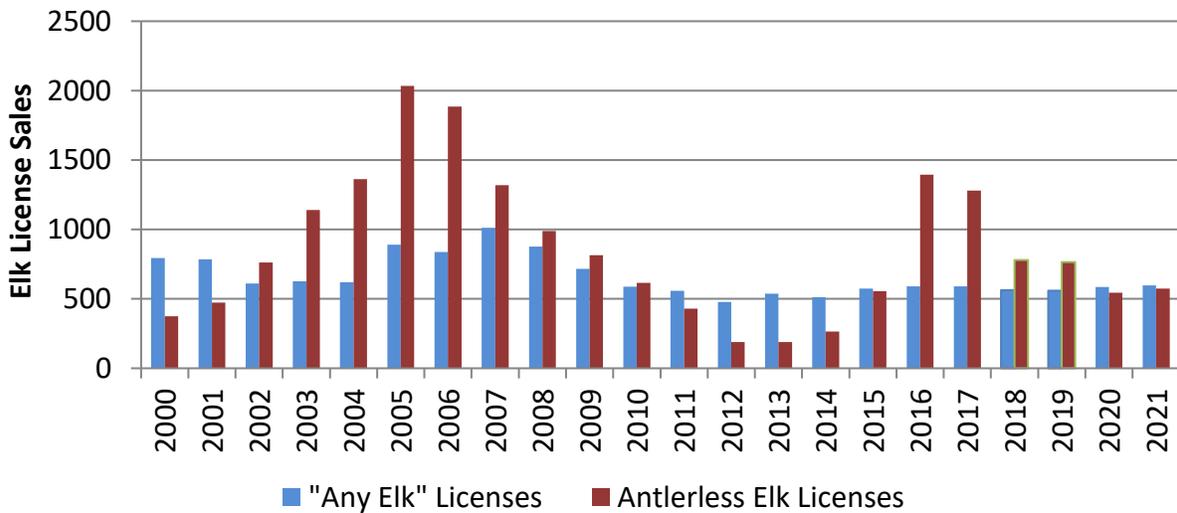


Figure 3. Total Black Hills elk license sales (firearm and archery) for antlerless and “any elk” license types, 2000-2021.

Public demand for firearm elk hunting licenses in the Black Hills is high, with 12,656 hunters applying for 940 available licenses in 2021 (Table 1). Hunters spent an average of 5.7 days pursuing elk in the 2021 firearm season and harvested a total of 619 elk. Harvest varies across

each hunting unit, but Unit 2 has a higher elk population and elk harvest than all other hunting units combined (Figure 4).

Firearm hunter success rates for all license types in the Black Hills have varied from 49% to 71% over that past 10 years. The South Dakota Elk Action Plan (SDGFP 2021a; Objective 2H) established a minimum 75% hunter success threshold for hunters with an “any elk” Black Hills and CSP firearm license type. Black Hills firearm hunters with “any elk” licenses experienced success rates of 84% in 2021, thus exceeding the minimum thresholds established in the Elk Action Plan. Harvest success can vary substantially between years and units (Figure 5), but average success for hunters with “any elk” firearm licenses across all units in the Black Hills has ranged from 76% to 85% over the past 10 years.

Table 1. Black Hills Firearm elk harvest, 2012-2021 (Huxoll 2022).

Year	# Apps 1st Choice	Licenses Sold	Bulls Harvest	Cows Harvest	Total Harvest	Success Rate	Avg. Days Hunted	Average Satisfaction
2012	9,665	570	291	125	416	73%	6.37	5.3
2013	11,274	620	272	103	374	60%	6.63	4.65
2014	11,461	664	295	178	472	71%	5.85	5.46
2015	12,126	922	312	345	657	71%	6.66	5.54
2016	12,692	1,745	363	724	1,087	62%	4.59	5.42
2017	12,201	1,581	364	682	1,047	66%	4.77	5.5
2018	11,871	1,124	315	402	717	64%	5.08	5.36
2019	12,396	1,108	332	354	686	62%	5.00	5.48
2020	13,198	926	360	224	585	63%	5.35	5.33
2021	12,656	954	370	249	619	65%	5.70	5.40

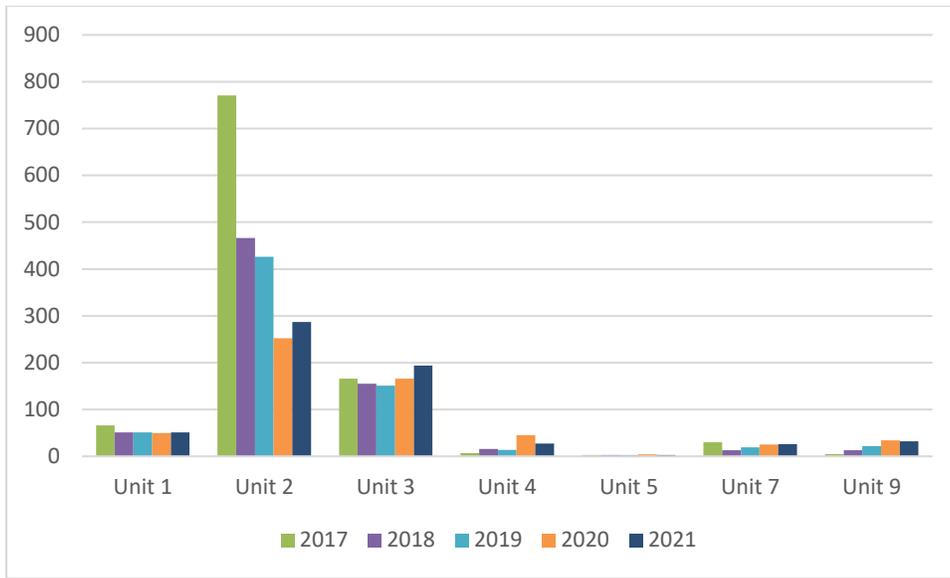


Figure 4. Black Hills firearm elk harvest for each elk hunting unit, 2017-2021.

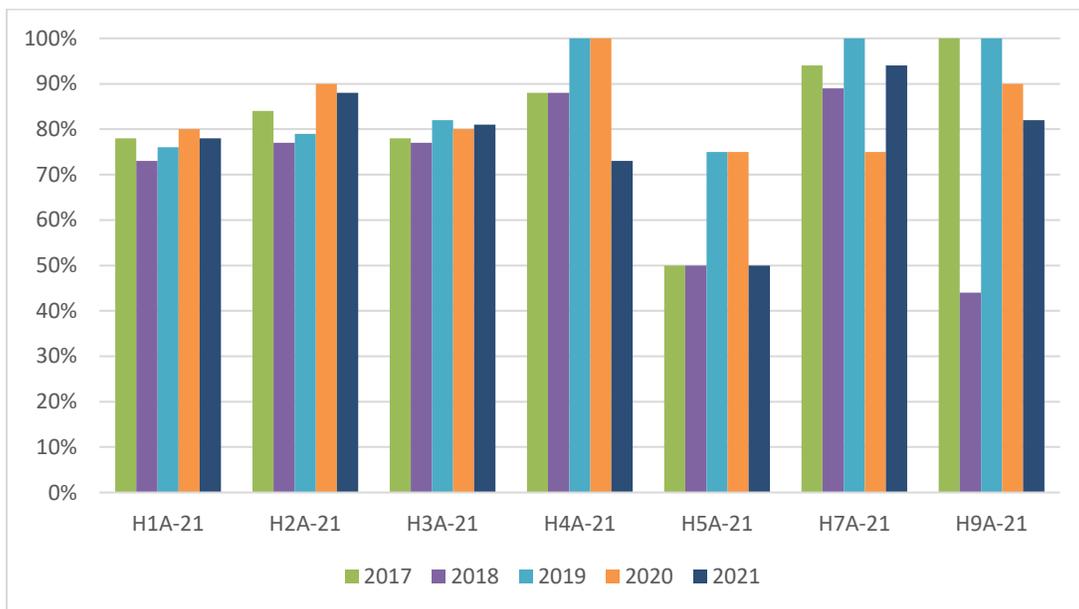


Figure 5. Black Hills firearm “any elk” license harvest success for each elk hunting unit, 2017-2021.

Similar to firearm seasons, public demand for archery elk hunting opportunities in the Black Hills is high with 5,966 hunters applying for 219 available archery elk licenses in 2021 (Table 2). Hunters spent an average of 11.2 days pursuing elk in the 2021 archery season and harvested a total of 96 elk. The Black Hills Unit 2 maintains the highest numbers of elk, ultimately

producing higher archery harvest in this unit compared to all other Black Hills elk units combined (Figure 6).

Overall archery success rates the past 10 years have varied from a low of 26% in 2017 to a high of 45% in 2020 (Table 2). Success for those archery hunters with an “any elk” license in 2021 ranged from a low of 0% in Unit 5 (2 licenses) to a high of 64% in Unit 2 (81 licenses).

Table 2. Archery elk harvest in the Black Hills, 2012-2021 (Huxoll 2022).

Year	# Apps 1 st Choice	Licenses Sold	Bull Harvest	Cow Harvest	Total Harvest	Success	Avg. Days Hunted	Average Satisfaction
2012	3,228	97	33	4	38	39%	11.94	5.34
2013	3,952	107	33	3	36	34%	11.97	5.59
2014	4,256	106	38	4	42	40%	11.68	5.61
2015	4,761	196	55	12	66	34%	11.74	5.39
2016	4,965	280	57	25	82	29%	11.11	5.4
2017	4,892	269	50	20	70	26%	11.29	5.6
2018	5,006	219	65	19	84	38%	11.70	5.5
2019	5,382	216	77	14	91	42%	11.08	5.6
2020	5,884	204	80	12	92	45%	11.24	5.9
2021	5,966	219	82	14	96	44%	11.18	5.89

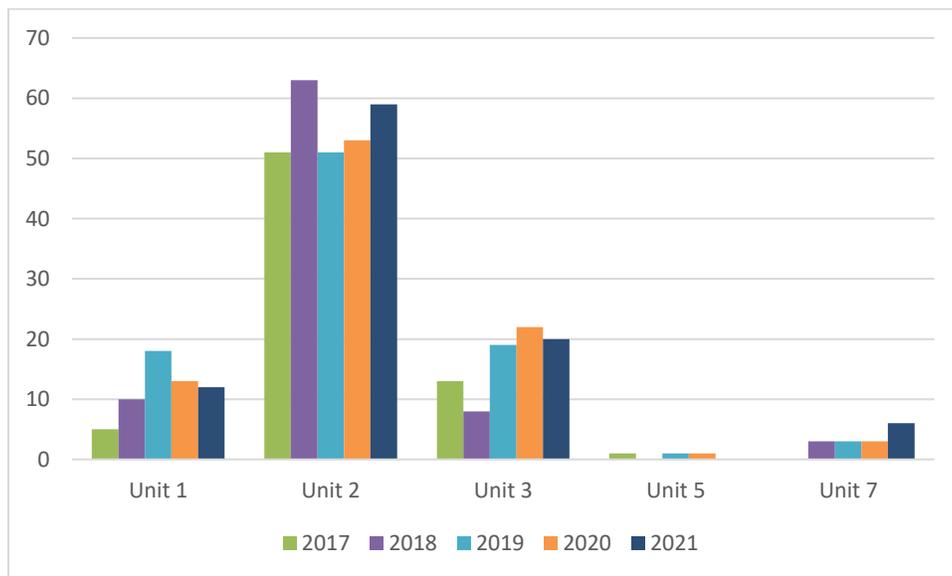


Figure 6. Black Hills Archery elk harvest, 2017-2021.

The 2021 elk season in Custer State Park began with the CSP archery season which was open September 1-30 (ARSD 41:06:28). The “any elk” CSP firearm season was open October 1 – October 31 (ARSD 41:06:27). There was no “antlerless-only” CSP firearm season in 2021. Public demand for elk hunting opportunities in CSP greatly exceeds supply, with 9,215 hunters applying for 8 firearm licenses and 4,456 applicants for 3 archery licenses in 2021 (Table 3). Hunters spent an average of 11.3 days and 1.6 days pursuing elk in the 2021 archery and firearm seasons, respectively.

Eight firearm hunters in 2021 with an “any elk” license in CSP averaged 100% success (8 elk harvested) and exceeded the minimum 75% success threshold established in the South Dakota Elk Action Plan (SDGFP 2021a; Objective 2H). Success for “any elk” firearm license holders over the past 5 years has ranged from a low of 50% (2018) to a high of 100% (2021). Archery hunters in CSP averaged 33% success (1 elk harvested) in 2021 for the three licenses issued (Table 3), but success has ranged from 33-100% the past 5 years (Table 3).

The Prairie Elk season dates vary based on the movement of elk and the management objectives within each unit, but start as early as July, and some contain a late season in February (ARSD 41:06:49). The number of licenses issued substantially increased in 2020 and 2021, primarily to address a growing elk population and depredation concerns. Hunters spent an average 6.6 days to harvest a total 128 elk in 2021. Average hunter success was 50% in 2021 for prairie elk hunters in South Dakota (Table 4).

Harvest Age Structure

Successful hunters are required to check-in harvested elk to a SDGFP representative within 24 hours (ARSD 41:06:04:19), at which time the middle two incisor teeth are removed from the harvested elk for aging purposes. Numerous check stations throughout the Black Hills are also established during the elk season to provide better convenience for hunters. Age structure data are used to assess herd status and evaluate harvest strategies. In 2021, approximately 750 usable teeth were returned from hunters. All Black Hills teeth visually determined to be > 1 year of age were sent to Matson’s Laboratory (Manhattan, MT) to be aged using cementum annuli techniques.

Table 3. Elk harvest in Custer State Park, 2015-2021 (Huxoll 2022).

Hunting Season	Year	Applications	Licenses	Harvest		Success	Avg. Days Hunted	Average Satisfaction
				Bull	Cow			
Archery	2015	3,600	4	3	0	75%	16.3	6.5
	2016	3,707	3	1	0	33%	15	6
	2017	3,704	3	1	0	33%	9.7	5.7
	2018	3,772	3	2	0	50%	11.0	5.5
	2019	4,055	3	3	0	100%	5.0	7.00
	2020	4,353	3	1	0	33%	13.7	6.5
	2021	4,456	3	1	0	33%	11.3	6.33
Firearm "Any Elk"	2015	9,136	8	8	0	100%	1.9	6.88
	2016	8,958	9	8	0	89%	2.8	6.56
	2017	8,828	9	8	0	88%	2.3	6.71
	2018	8,670	9	8	0	86%	5.7	5.71
	2019	8,949	9	8	0	89%	2.8	6.25
	2020	9,385	9	8	0	89%	5.8	6.89
	2021	9,215	8	8	0	100%	1.6	6.86
Firearm Antlerless Elk	2011-15	Closed	-	-	-	-	-	-
	2016	3,138	20	0	18	90%	2.2	6.2
	2017	3,436	29	1	24	86%	2.1	5.83
	2018	3,175	23	0	4	19%	3.35	2.19
	2019-21	Closed	-	-	-	-	-	-

Table 4. Prairie Firearm Elk harvest, 2010-2021 (Huxoll 2022).

Year	Licenses Sold	Bull Harvest	Cow Harvest	Total Harvest	Success	Avg. Days Hunted	Average Satisfaction
2010	134	24	27	51	38%	3.92	4.00
2011	128	20	15	35	27%	4.03	4.02
2012	97	26	20	46	47%	5.22	4.72
2013	96	18	13	30	32%	4.81	4.15
2014	92	33	25	59	64%	3.73	5.31
2015	98	29	25	54	55%	4.59	5.34
2016	148	32	27	60	40%	4.76	4.68
2017	149	41	34	75	50%	6.43	4.81
2018	139	59	51	109	79%	5.55	5.58
2019	140	41	50	91	65%	5.73	5.43
2020	251	56	87	143	57%	5.97	5.02
2021	257	57	71	128	50%	6.57	5.05

Of the 404 Black Hills firearm and archery bull teeth aged, 80% were assessed to be 4 years of age or older (Figure 7). For CSP, 100% of the bulls harvested (9) in 2021 were 4+ years of age. The South Dakota Elk Action Plan (SDGFP 2021a; Objective 2I) establishes that SDGFP will manage the Black Hills and CSP elk hunting seasons (firearm and archery combined) for an average bull harvest age structure of 60% bulls 4+ years of age. Both CSP and the Black Hills elk seasons are over the age objective and have been for several years (Figure 7). The 4-year average for Black Hills unit bulls harvested in the firearms and archery seasons combined is 2% calves, 3% yearlings, 19% 2-3 year-olds, and 75% 4+ year-olds. The 4-year average for CSP unit bulls harvested in the firearms and archery seasons combined is 8% 2-3 year-olds and 92% 4+ year-olds.

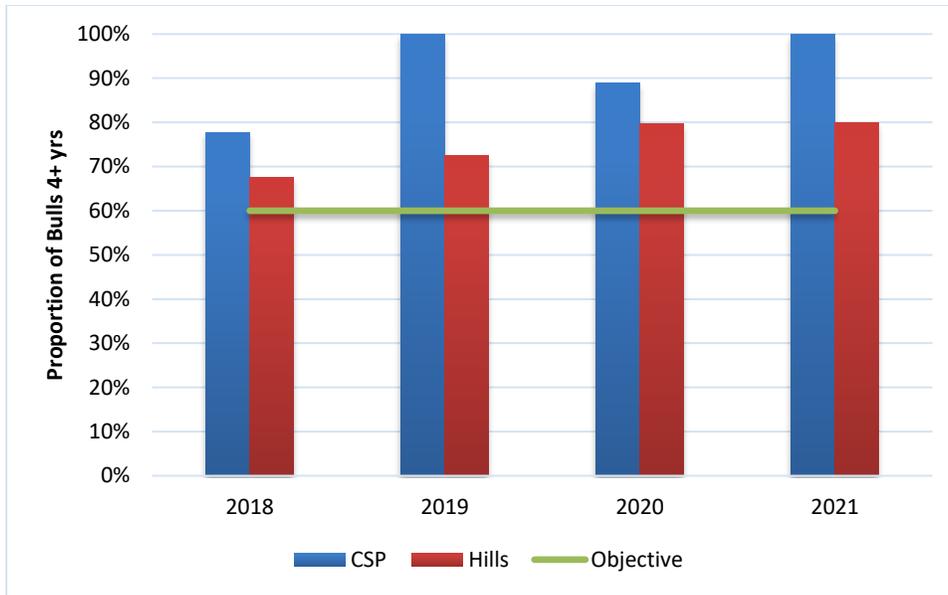


Figure 7. The proportion of bulls harvested that are 4 years of age or older in Custer State Park and the Black Hills firearm and archery elk hunting seasons, 2018-2021. The management objective of 60% is identified by the green line.

CWD Testing of Harvested Elk

The first documentation of Chronic Wasting Disease (CWD) in free-roaming wildlife in South Dakota was in 2001 in a white-tailed deer in Fall River County. The first free-roaming elk that tested positive for CWD was found in 2002 within Wind Cave National Park (WICA). Since 2002, CWD has been found in a total of 259 elk from a sampling effort of 7,644 elk in and around the Black Hills (166 CWD positive elk were collected from within WICA, and 33 CWD positive elk have been collected from CSP). A voluntary testing program is in place for hunters to submit samples from harvested elk and receive CWD test results. In the past two years, 240 elk have been tested with 24 returning positive for CWD (12 positive CWD results are from WICA, and 1 from CSP). The locations of CWD positive elk over the last 2 years are focused in and around WICA and the eastern side of the Black Hills. One CWD positive elk has been found on the prairie in Bennet County (Figure 8). Recent research conducted in Colorado suggests that in areas of high CWD prevalence, CWD can reduce survival rates of cow elk and decrease elk population growth (Monello et al. 2014). The long-term impacts of CWD on elk populations in South Dakota are concerning, but remain largely unknown.

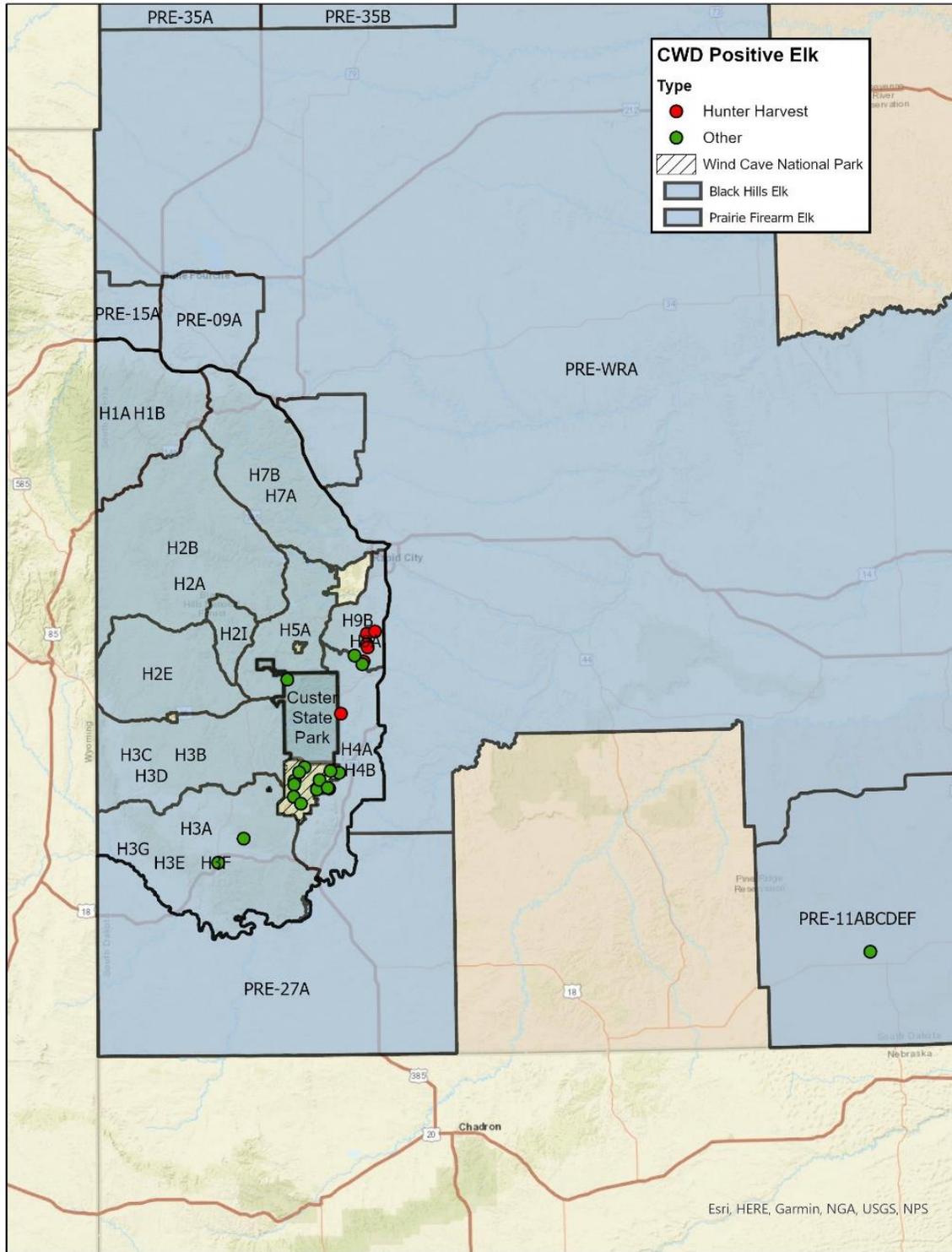


Figure 8. Map of CWD positive elk collected from hunter harvest or other collection methods, 2020-2021.

Herd Composition Surveys

Pre-hunting season herd composition surveys are completed by driving roads or hiking in areas of known elk concentrations in August. Surveys are concentrated in locations across the Black Hills according to where elk are distributed and can be observed. All elk herds that are observed in their entirety are classified to numbers of calves, cows, and bulls. Location and date of observations are also recorded in order to reduce double-counting occurrences. Herd composition survey data are analyzed to assess sex and age ratios.

Adult sex ratios are calculated as bulls:100 cows, but potentially could under-represent antlered bulls as large calf/cow groups are likely more detectable during this time of year. Elk survey protocol during previous years allowed surveys to be completed in both August and September, but annual differences in ratios could be reflective of monthly observations if sampling strategies differed between years.

Age ratios are calculated as calves:100 cows and are used as an indicator of fall recruitment into the population. An annual recruitment rate is derived using fall age ratio data along with previously gathered survival rates of radio-collared calves from October through May (Simpson 2015).

In 2021, 1,533 elk were classified throughout the Black Hills and 495 in CSP during the fall herd composition survey. Age and sex ratios, along with binomial (95%) confidence intervals using individuals as the sampling unit were calculated for each Black Hills and CSP. Herd composition in the Black Hills was 24 bulls:100 cows (95% CI: 21-28) and 46 calves:100 cows (95% CI: 41-52, Figures 9 and 10). The long-term 15-year bull ratio is 26 bulls:100 cows, while the 3-year average (2019-21) that is used in modeling predictions of future populations is 25 bulls:100 cows. The long-term 15-year fall recruitment average is 47 calves:100 cows, while the 3-year average is 45 calves:100 cows. In CSP, herd composition was 38 calves:100 cows (95% CI: 30-47) and 34 bulls:100 cows (95% CI: 27-43) in 2021 (Figures 9 and 10).

Survival Monitoring

Obtaining knowledge of calf and adult elk survival rates is useful for understanding population dynamics and projecting elk trends in the Black Hills. Annual rates of change within an elk population are influenced primarily by adult female survival. Another important metric is number of calves that reach one year of age. In 2012 and 2013, 71 neonatal calves ≤ 10 days old were captured and fitted with VHF radio collars. Data from the collars suggested a high survival rate, 75% (95% CI: 56-84%), from birth to one year old, and 12 of 16 mortalities were caused by mountain lion predation (Simpson 2015). Since 2015, adult cow survival in the Black Hills has been monitored annually by maintaining a representative sample of radio collared cow elk. As of March 2021, there were approximately 128 cows being monitored monthly to assess annual survival rates. Additional adult cow elk will be captured and collared as needed based on budget and Department priorities.

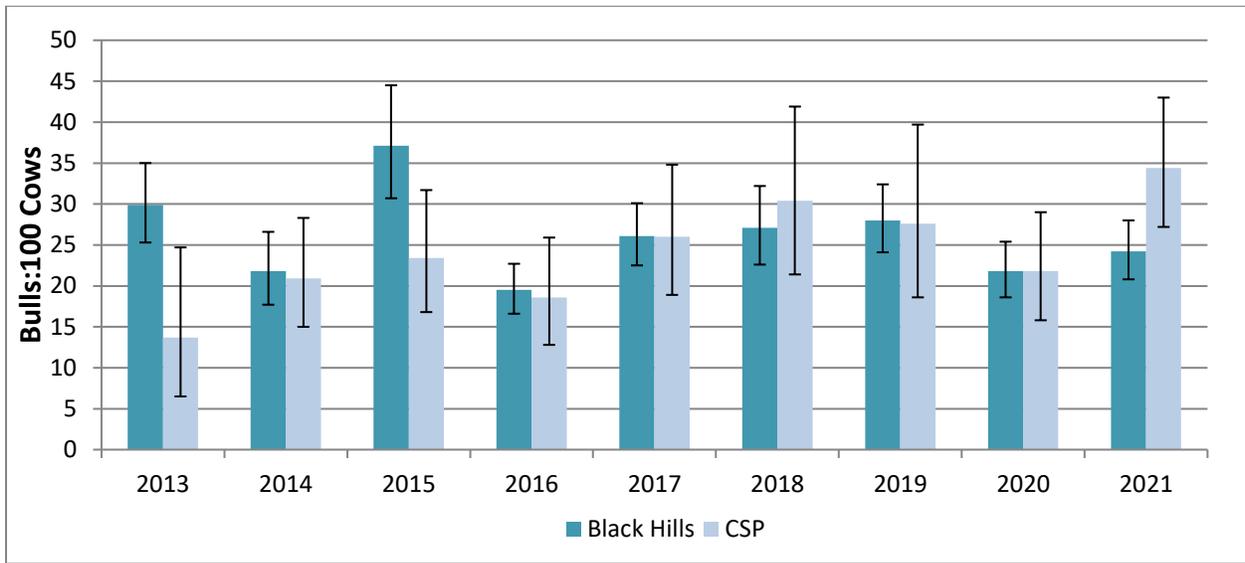


Figure 9. Fall sex ratios of elk (with 95% error bars) in the Black Hills and CSP, 2013-2021.

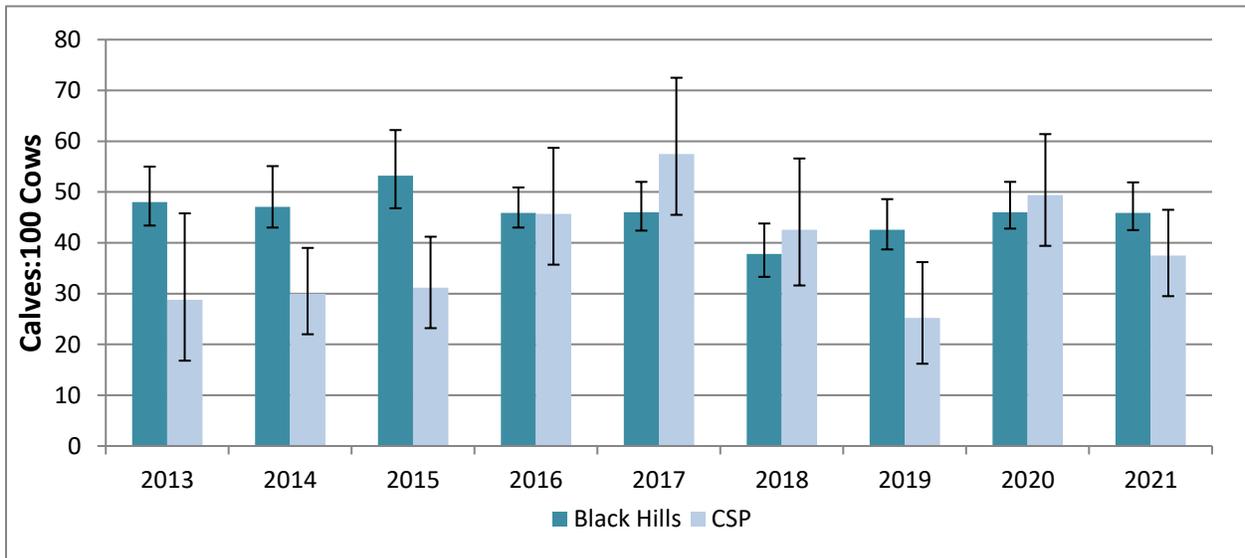


Figure 10. Fall age ratios of elk (with 95% error bars) in the Black Hills and CSP, 2013-2021.

Within the Black Hills, adult cows were captured via helicopter dart gunning and chemically immobilized using a combination of butorphanol, azaperone, and medetomidine (BAM; ZooPharm, Laramie, WY). Blood samples were collected in previous years to evaluate pregnancy status, but these efforts were ceased in 2019 because precise ages are not collected on collared animals and thus results were determined to be of minimal value.

Monitoring alive or dead status occurs within 12-16 days post-capture and all mortalities (<16 days post capture) are labeled as capture-related mortalities, except for vehicle mortalities. Monitoring then occurs one time each month between the 1st -15th for each collared individual. All mortalities are investigated to verify death of the animal via physical evidence. In most cases, cause-specific mortality is not identifiable except for vehicle collisions and hunter harvest. Hunter harvest is an important metric used in population modeling and collar reporting by hunters is a vital step in obtaining the most accurate data possible. Survival rates were calculated from time-to-event data using a hierarchical piecewise constant hazard model, smoothed among monthly intervals. The multinomial distribution partitioned hazards to estimate cause-specific mortality rates that were used in population projection models (Table 5; Walsh et al. 2018).

From 2015 to 2020 GFP captured and radio collared approximately 260 adult elk in the Black Hills. Population models are heavily data driven and reliable abundance and trend estimates require statistically valid survival estimates. Survival of adult cows in 2021 was high at 94% and likely the result of a growing elk population and conservative antlerless harvest.

Captured animals have traditionally been collared with VHF radio collars, but all 35 captured cow elk in 2020 were fitted with GPS collars to provide additional data on elk movements and habitat use. Many of the elk captured and wintering in the Jasper fire area exhibit migratory behaviors similar to what was documented by Simpson (2015), but elk in other herds appear to remain more localized in many parts of the Black Hills (Figure 11). Formal analyses and write-up will occur in the future when elk monitoring has been completed.

Table 5. Black Hills adult (>1-year-old) cow elk annual survival and cause-specific mortality rates, 2015-2021.

Year	Survival	Harvest Rate	Other Mortality Rate	# Monitored
2015	87% (78 - 94%)	7% (2 - 13%)	6% (2 - 12%)	81
2016	76% (67 - 83%)	20% (13 - 28%)	5% (2 - 9%)	102
2017	70% (61 - 78%)	21% (14 - 30%)	9% (4 - 15%)	109
2018	82% (75 - 88%)	10% (6 - 16%)	8% (4 - 13%)	116
2019	85% (78 - 91%)	9% (5 - 14%)	6% (3 - 11%)	141
2020	86% (80-91%)	4% (2-7%)	10% (6-15%)	151
2021	94% (88 - 98%)	3% (1 - 8%)	3% (1 - 7%)	114

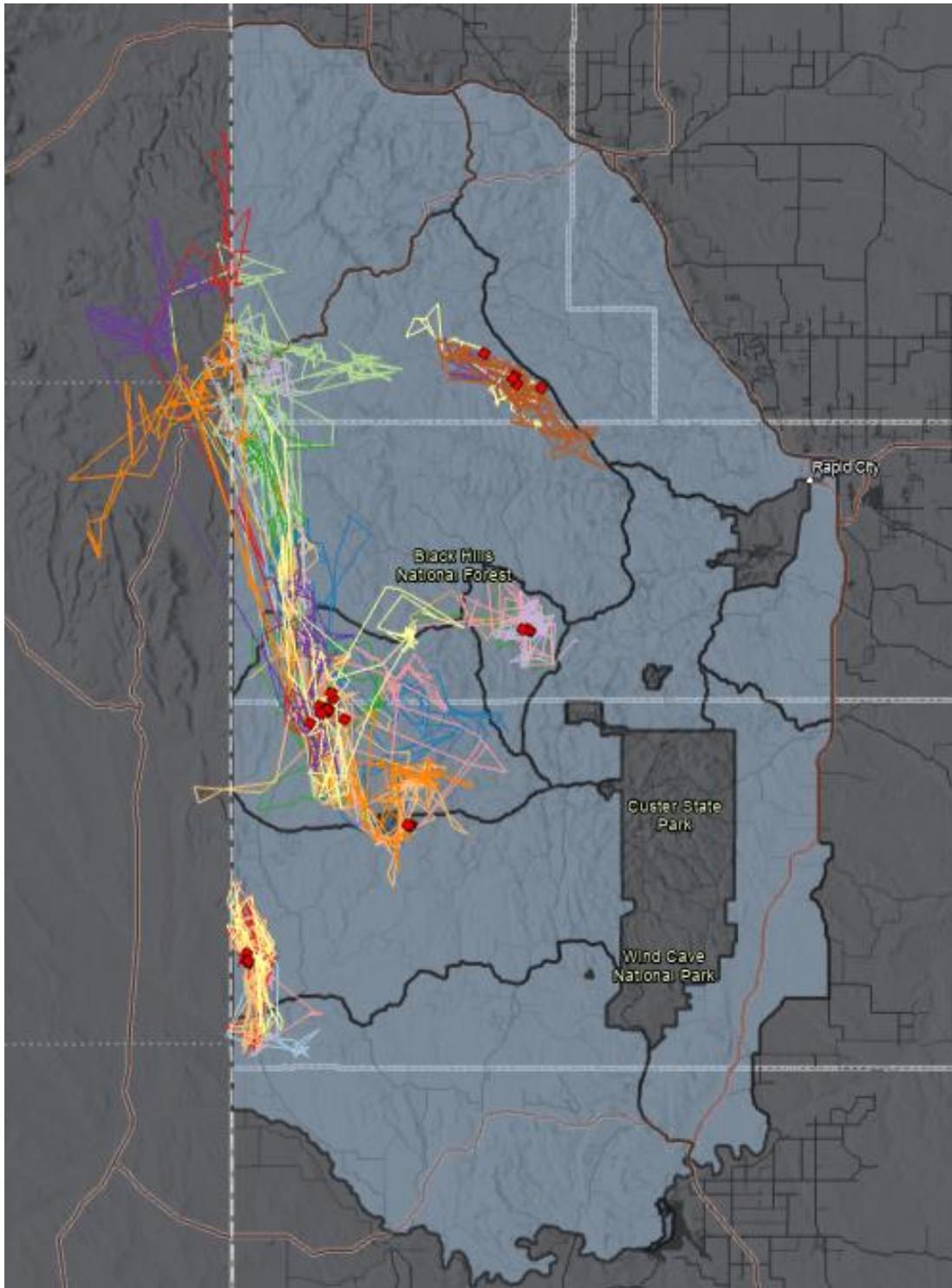


Figure 11. Capture locations (red dots) and weekly movements (which includes an average of all the locations for a week at a time) with each colored line representing a unique individual adult cow elk wearing a GPS radio collar in the Black Hills of South Dakota, January 2020 – October 2021.

Aerial Sightability Surveys

In 2009, efforts began to develop an elk aerial sightability model specific to the Black Hills of South Dakota (Jarding 2010, Phillips 2011, SDGFP unpublished). The resulting model estimated elk sightability as $\mu = 0.1446 - 0.0361$ (% visual obstruction) + 0.1001 (group size) + 0.0158 (% snow cover) and is currently used to correct for elk missed during the aerial survey in the Black Hills.

Aerial surveys of the entire Black Hills have been completed in 2013, 2016, and 2020 (Figure 12). A total of 5,834 elk were counted in 2020 (Figure 13) in the Black Hills hunting units excluding CSP and WICA National Park. The 2020 sightability model winter estimate of elk in the Black Hills (excluding CSP and WICA) was 6,483 (95% CI: 6,098 – 7,958) elk. Within CSP, 435 elk were counted, and the model adjusted 2020 estimate was 457 (95% CI: 442 – 544). Survey crews also counted 1,519 elk in portions of the Wyoming Black Hills, with a model adjusted estimate of 1,687 (95% CI: 1,584 - 2,118) elk.

Aerial surveys provide great information on the wintering distribution of elk in the Black Hills (Figure 13). The Black Hills population objective (excluding CSP and WICA) is 6,000 to 8,000 depending on habitat conditions (SDGFP 2021a). Assessing elk unit densities during the fall hunting seasons is accomplished by distributing the Black Hills winter estimate into each elk unit using previous years' average harvest proportions and trail camera survey data. Unit license allocations and unit population estimates and trends are then combined to ensure overall Black Hills elk are managed within the established objective range.

Aerial elk surveys are conducted every four years (SDGFP 2021a), with the next one scheduled for 2024. Population estimates from aerial surveys will be compared with modeled population projections to validate modeling efforts in years without surveys.



Figure 12. Photo of elk herd during aerial sightability survey, 2016.

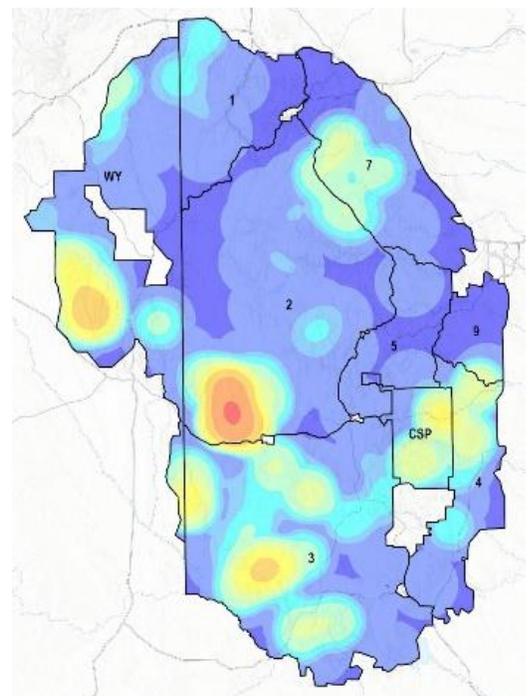


Figure 13. Aerial Sightability survey heat map of elk counts in 2020.

Population Modeling

Population projection models are used to annually estimate abundance and rate of population change for 3 of every 4 years when aerial estimates are not available. Data from aerial surveys in 2020 resulted in an estimate of 6,483 elk wintering in the Black Hills. Population projections incorporate herd composition ratios, wounding, non-hunting mortality, and emigration rates, and harvest. A 3-year average of 25 adult bulls:100 adult cows from 2019-2021 fall herd composition data was used to estimate adult bulls and adult cows on September 1 (fall) from the 2020 aerial survey estimate, assuming 98% survival from the aerial survey to the hunting season. Calves were recruited into the fall population by multiplying the adult cows by the 2019-2021 average of 45 calves:100 adult cows. Next, cohort-specific harvest, multiplied by 15% to account for wounding loss, was subtracted from the fall population. Annual (Sep. 1 to Aug. 31) calf non-hunting mortality (27%), adult female non-hunting mortality (7%), and adult bull non-hunting mortality (15%), estimated from radio collared elk in the Black Hills, was used to remove annual non-hunting losses from each fall population cohort. In addition, bull calf emigration rates are used to account for net losses of bull calves from yearling dispersal. To predict how tag recommendations may impact growth rates, change in harvest is assumed to be additive to non-hunting mortality rates. Changes in license type allocations from the previous year were multiplied by 5-year average license type success rates, and the resulting harvest estimates were used with average non-hunting mortality, wounding loss, emigration, and recruitment rates to project the population in future years. Population parameters were optimized by comparing projections between winter aerial survey estimates in 2013, 2016 and 2020. Population projection results suggested the overwinter Black Hills elk population of 6,483 increased 9% between 2020 and 2022, and the population is expected to increase another 2% between 2022 and 2024 based on proposed hunting season recommendations.

A different projection model is used in CSP to estimate abundance and rate of change during years when aerial estimates are not available. Data from aerial surveys in 2020 resulted in an estimate of 457 elk wintering in CSP. The aerial survey estimate is used to project the population through time using a Lefkovitch matrix model. The matrix model is a post-breeding model which includes male and female calves, male and female yearlings, 2+ year old males, 2-7 year-old females, and 8+ year-old females. Survival rates, pregnancy rates, and fecundity were used to estimate future abundance. Confidence intervals for annual abundance estimates are developed using Monte Carlo simulation methods, which fully accounts for uncertainty in all input variables. To predict how different tag recommendations may impact growth rates, change in harvest is assumed to be additive, and various harvest simulations are conducted to ensure CSP is maintaining the elk population objective.

SUMMARY

The SDGFP conducts several surveys and assessments to better understand elk population abundance and trends in the Black Hills. SDGFP establishes hunting unit objectives to manage elk densities towards the overall population objective of 6,000 to 8,000 wintering elk in the Black Hills and 500 to 600 wintering elk in Custer State Park, all dependent upon habitat conditions (SDGFP 2021a). Surveys are completed annually or periodically to assess harvest, disease, herd composition, reproduction, survival, and abundance.

Hunter surveys and mandatory elk check-ins are conducted annually to estimate harvest, hunter success and satisfaction, and harvested elk age structure. Minimum harvest success thresholds for hunters with “any elk” licenses in the Black Hills and CSP were established in the South Dakota Elk Action Plan (SDGFP 2021a); success thresholds for both areas are being met and exceeded. In addition, minimum harvest age objectives established in the Elk Management Plan were also exceeded the past four years.

Annual herd composition surveys provide critical information on fall recruitment and bull to cow ratios of the elk herd. Over the past three years, calf-to-cow and bull-to-cow ratios in the Black Hills have averaged 45 calves:100 cows and 25 bulls:100 cows, respectively. Annual capture and radio collaring efforts provide an opportunity to gather important data on survival rates; monitoring of radio collared adult cow elk survival provides insights on the impacts of antlerless harvest rates and population trends. Conservative antlerless harvest has resulted in high cow survival in 2021 (94%) and elk populations in the Black Hills have been increasing given current survival and recruitment.

Sightability surveys are completed every four years and provide periodic abundance estimates of wintering elk herds, and important “anchor points” for population models. Aerial surveys completed in the winter of 2020 resulted in an elk estimate of approximately 6,500 in the Black Hills and 450 in CSP. Population models projected the Black Hills elk population slightly increased through the winter of 2022 to an approximate 7,000 in the Black Hills, while CSP elk populations appear to have remained relatively stable. Assuming future elk population demographics are similar to current observations, along with increased elk harvest rates, elk growth rates in the Black Hills will be reduced but projected to still grow slightly.

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